

What is claimed is:

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- 5 1. A router comprising:
a computer readable medium;
a plurality of transmission links for receiving and
sending data;
retrieving means for retrieving a destination address
10 from a data packet;
hashing means for hashing the destination address to
determine a table index into a table; and
reading means for reading a target address from a table
entry using the table index, wherein the target address has
15 been related to and stored in the table entry based on a
computed value from a relation computation using the table
index and the target address as operands in the relation
computation; and
modifying means for modifying the data packet by
20 storing the target address in the data packet as a next-hop
destination address.
2. The router of claim 1 further comprising relating means
for relating a particular table entry to a target address
25 wherein:
generating means for generating, for each target
address in the set of target addresses, a computed value
using the table index for the particular table entry and a
target address as operands in the relation computation to
30 obtain a set of computed values;

choosing means for choosing a computed value from the set of computed values based upon a mathematical relationship among the set of computed values; and

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3. The router of claim 2 further comprising:

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storing means for storing in each table entry its related target address.

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receiving a data packet;
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retrieving a destination address from the data packet;
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hashing the destination address to determine a table index into a table in a computer readable medium; and

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transmitting the modified data packet.

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6. The method of claim 5 further comprising:

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for each table entry, storing in a table entry its related target address.

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wherein a single target identifier is related to one or more entry locations;

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5      retrieving information associated with the target
      identifier from the entry in the data structure using the
      location identifier; and

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10 wherein a processing speed with which the source
 identifier is mapped to the mapped target identifier is
 independent of a total number of target identifiers in the
 set of target identifiers.

9. A method in a data processing system for mapping a
20 source identifier to a target identifier, the method
comprising the steps of:

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10. The method of claim 9 further comprising a step of relating a particular table entry to a target identifier in which:

choosing a computed value from the set of computed values based upon a mathematical relationship among the set of computed values; and

11. The method of claim 10 further comprising, prior to the step of reading the target identifier from the table entry:

obtaining a set of target identifiers; and

for each table entry, relating a target identifier from the set of target identifiers to a table entry such that each table entry is related with only one target identifier; and

for each table entry, storing in a table entry its related target identifier.

12. The method of claim 10 further comprising:

dynamically removing a target identifier from a set of target identifiers to obtain a modified set of target identifiers;

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for each table entry previously related to the removed target identifier, newly relating a target identifier from the modified set of target identifiers to a table entry such that each table entry is related with only one target

5 identifier; and

for each table entry previously related to the removed target identifier, storing in a table entry its newly related target identifier.

10 13. The method of claim 10 further comprising:

dynamically adding a target identifier to a set of target identifiers to obtain a modified set of target identifiers;

15 for each table entry, relating a target identifier from the modified set of target identifiers to a table entry such that each table entry is related with only one target identifier; and

for each table entry, storing in a table entry its related target identifier if its related target identifier differs from a target identifier previously stored in the table entry.

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14. The method of claim 9 wherein the relation computation further comprises:

25 receiving the table index and the target identifier as operands for the relation computation;

hashing the table index to generate a first hash value;

hashing the target identifier to generate a second hash value; and

30 hashing the first hash value and the second hash value to generate a computed value.

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15. The method of claim 9 further comprising:

obtaining a set of target identifiers, wherein each target identifier identifies a computational resource such that each target identifier is related with only one computational resource.

16. The method of claim 9 further comprising:

associating a computational resource with a subset of a set of target identifiers, wherein each target identifier in the set of target identifiers is related with only one computational resource, wherein each target identifier in the subset of target identifiers identifies the computational resource, and wherein a size of the subset of target identifiers is proportional to a computational capacity of the computational resource.

17. The method of claim 9 wherein the source identifier is a network protocol address.

18. The method of claim 9 wherein the target identifier is a network physical address.

19. The method of claim 9 wherein the target identifier is a Uniform Resource Identifier (URI).

20. An apparatus for mapping a source identifier to a target identifier comprising:

first hashing means for hashing the source identifier to determine a table index into a table in a computer readable medium; and

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reading means for reading the target identifier from a table entry using the table index, wherein the target identifier has been related to and stored in the table entry based on a computed value from a relation computation using the table index and the target identifier as operands in the relation computation.

21. The apparatus of claim 20 further comprising first relating means for relating a particular table entry to a target identifier wherein:

generating means for generating, for each target identifier in the set of target identifiers, a computed value using the table index for the particular entry and a target identifier as operands in the computation to obtain a set of computed values;

choosing means for choosing a computed value from the set of computed values based upon a mathematical relationship among the set of computed values; and

determining means for determining a related target identifier for the particular table entry based on the chosen computed value, wherein the chosen computed value was computed using the related target identifier as input.

22. The apparatus of claim 21 further comprising:

first obtaining means for obtaining a set of target identifiers; and

second relating means for relating, for each table entry, a target identifier from the set of target identifiers to a table entry such that each table entry is related with only one target identifier; and

first storing means for storing in each table entry its related target identifier.

removing means for dynamically removing a target identifier from a set of target identifiers to obtain a modified set of target identifiers;

second storing means for storing, in each table entry previously related to the removed target identifier, its newly related target identifier.

adding means for dynamically adding a target identifier to a set of target identifiers to obtain a modified set of target identifiers; and

third storing means for storing in each table entry its related target identifier if its related target identifier differs from a target identifier previously stored in the table entry.

25. The apparatus of claim 20 further comprising a relation computation means for computing the relation computation wherein:

second hashing means for hashing the table index to generate a first hash value;

fourth hashing means for hashing the first hash value and the second hash value to generate a computed value.

15 second obtaining means for obtaining a set of target
identifiers, wherein each target identifier identifies a
computational resource such that each target identifier is
related with only one computational resource.

associating means for associating a computational resource with a subset of a set of target identifiers, wherein each target identifier in the set of target identifiers is related with only one computational resource, wherein each target identifier in the subset of target identifiers identifies the computational resource, and wherein a size of the subset of target identifiers is proportional to a computational capacity of the computational resource.

28. The apparatus of claim 20 wherein the source identifier is a network protocol address.

29. The apparatus of claim 20 wherein the target identifier
5 is a network physical address.

30. The apparatus of claim 20 wherein the target identifier is a Uniform Resource Identifier (URI).

31. A computer program product on a computer readable medium for use in a data processing system for mapping a source identifier to a target identifier, the computer program product comprising:

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        instructions for hashing the source identifier to
15    determine a table index into a table in a computer readable
        medium; and

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instructions for reading the target identifier from a table entry using the table index, wherein the target identifier has been related to and stored in the table entry based on a computed value from a relation computation using the table index and the target identifier as operands in the relation computation.

32. The computer program product of claim 31 further
25 comprising instructions for relating a particular table
entry to a target identifier including:

instructions for generating, for each target identifier in the set of target identifiers, a computed value using the table index for the particular table entry and a target identifier as operands in the relation computation to obtain a set of computed values;

instructions for choosing a computed value from the set of computed values based upon a mathematical relationship among the set of computed values; and

instructions for determining a related target

10 comprising:

instructions for obtaining a set of target identifiers;
and

15 table entry such that each table entry is related with only
one target identifier; and

instructions for storing in each table entry its related target identifier.

20 34. The computer program product of claim 32 further
comprising:

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        instructions for dynamically removing a target
        identifier from a set of target identifiers to obtain a
        modified set of target identifiers;

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25 instructions for newly relating, for each table entry
previously related to the removed target identifier, a
target identifier from the modified set of target
identifiers to a table entry such that each table entry is
related with only one target identifier; and

instructions for storing, in each table entry previously related to the removed target identifier, its newly related target identifier.

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        instructions for dynamically adding a target identifier
to a set of target identifiers to obtain a modified set of
target identifiers;

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instructions for storing in each table entry its related target identifier if its related target identifier differs from a target identifier previously stored in the table entry.

instructions for receiving the table index and the target identifier as operands for the relation computation;

25 instructions for hashing the target identifier to
generate a second hash value; and

instructions for hashing the first hash value and the second hash value to generate a computed value.

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37. The computer program product of claim 31 further comprising:

instructions for obtaining a set of target identifiers, wherein each target identifier identifies a computational resource such that each target identifier is related with only one computational resource.

38. The computer program product of claim 31 further comprising:

instructions for associating a computational resource with a subset of a set of target identifiers, wherein each target identifier in the set of target identifiers is related with only one computational resource, wherein each target identifier in the subset of target identifiers identifies the computational resource, and wherein a size of the subset of target identifiers is proportional to a computational capacity of the computational resource.

39. The computer program product of claim 31 wherein the source identifier is a network protocol address.

40. The computer program product of claim 31 wherein the target identifier is a network physical address.

41. The computer program product of claim 31 wherein the target identifier is a Uniform Resource Identifier (URI).

42. A method in a data processing system for mapping a source identifier to a target identifier, the method comprising the steps of:

reading information associated with the target identifier from the entry in the data structure using the location identifier, wherein the information associated with the target identifier has been related to and stored in the entry based on a computed value from a relation computation using the location identifier and the target identifier as operands in the relation computation.

for each target identifier in the set of target identifiers, generating a computed value using the location identifier of the particular entry in the data structure and a target identifier as operands in the relation computation to obtain a set of computed values;

determining a related target identifier for the particular entry based on the chosen computed value, wherein the chosen computed value was computed using the related target identifier as input.

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44. The method of claim 43 further comprising, prior to the step of reading the information associated with the target identifier from the entry in the data structure:

obtaining a set of target identifiers; and

5 for each entry in the data structure, relating a target identifier from the set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier; and

10 for each entry in the data structure, storing in an entry information associated with its related target identifier.

45. The method of claim 43 further comprising:

15 dynamically removing a target identifier from a set of target identifiers to obtain a modified set of target identifiers;

20 for each entry in the data structure previously related to the removed target identifier, newly relating a target identifier from the modified set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier;

25 for each entry in the data structure previously related to the removed target identifier, storing in an entry information associated with its newly related target identifier.

46. The method of claim 43 further comprising:

30 dynamically adding a target identifier to a set of target identifiers to obtain a modified set of target identifiers; and

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for each entry in the data structure, relating a target identifier from the modified set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier; and

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    receiving the location identifier and the target
    identifier as operands for the relation computation;

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hashing the target identifier to generate a second hash value; and

48. The method of claim 42 further comprising:

49. The method of claim 42 further comprising:

associating a computational resource with a subset of a set of target identifiers, wherein each target identifier in the set of target identifiers is related with only one

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computational resource, wherein each target identifier in the subset of target identifiers identifies the computational resource, and wherein a size of the subset of target identifiers is proportional to a computational capacity of the computational resource.

50. The method of claim 42 further comprising:

retrieving the target identifier using the information associated with the target identifier; and

performing a computational process on a computational resource identified by the target identifier.

51. The method of claim 50 wherein the computational resource identified by the target identifier is a memory resource.

52. The method of claim 50 wherein the computational resource identified by the target identifier is a data processing system.

53. The method of claim 42 wherein the information associated with the target identifier comprises the target identifier.

54. The method of claim 42 wherein the data structure is a table, and the location identifier is a table index.

55. The method of claim 42 wherein the source identifier is a network protocol address.

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56. The method of claim 42 wherein the target identifier is a network physical address.

57. The method of claim 42 wherein the target identifier is
5 a Uniform Resource Identifier (URI).

58. An apparatus for mapping a source identifier to a target identifier comprising:

10 first hashing means for hashing the source identifier to determine a location identifier of an entry in a data structure in a computer readable medium; and

15 reading means for reading information associated with the target identifier from the entry in the data structure using the location identifier, wherein the information associated with the target identifier has been related to and stored in the entry based on a computed value from a relation computation using the location identifier and the target identifier as operands in the relation computation.

20 59. The apparatus of claim 58 further comprising first relating means for relating a particular entry in the data structure to a target identifier wherein:

25 generating means for generating, for each target identifier in the set of target identifiers, a computed value using the location identifier of the particular entry in the data structure and a target identifier as operands in the relation computation to obtain a set of computed values;

30 choosing means for choosing a computed value from the set of computed values based upon a mathematical relationship among the set of computed values; and

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determining means for determining a related target identifier for the particular entry based on the chosen computed value, wherein the chosen computed value was computed using the related target identifier as input.

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60. The apparatus of claim 59 further comprising, prior to the step of reading the information associated with the target identifier from the entry in the data structure:

first obtaining means for obtaining a set of target identifiers; and

second relating means for relating, for each entry in the data structure, a target identifier from the set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier; and

first storing means for storing, in each entry in the data structure, information associated with its related target identifier.

61. The apparatus of claim 59 further comprising:

removing means for dynamically removing a target identifier from a set of target identifiers to obtain a modified set of target identifiers;

third relating means for newly relating, for each entry in the data structure previously related to the removed target identifier, a target identifier from the modified set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier;

second storing means for storing, in each entry in the data structure previously related to the removed target

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identifier, information associated with its newly related target identifier.

62. The apparatus of claim 59 further comprising:

5 adding means for dynamically adding a target identifier to a set of target identifiers to obtain a modified set of target identifiers; and

fourth relating means for relating, for each entry in the data structure, a target identifier from the modified
10 set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier; and

third storing means for storing, in each entry in the data structure, information associated with its related
15 target identifier if its related target identifier differs from a target identifier previously related to the entry in the data structure.

63. The apparatus of claim 58 wherein the relation
20 computation further comprises:

receiving means for receiving the location identifier and the target identifier as operands for the relation computation;

second hashing means for hashing the location
25 identifier to generate a first hash value;

third hashing means for hashing the target identifier to generate a second hash value; and

fourth hashing means for hashing the first hash value and the second hash value to generate a computed value.

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64. The apparatus of claim 58 further comprising:

second obtaining a set of target identifiers, wherein
each target identifier identifies a computational resource
such that each target identifier is related with only one
5 computational resource.

65. The apparatus of claim 58 further comprising:

associating means for associating a computational
resource with a subset of a set of target identifiers,
10 wherein each target identifier in the set of target
identifiers is related with only one computational resource,
wherein each target identifier in the subset of target
identifiers identifies the computational resource, and
wherein a size of the subset of target identifiers is
15 proportional to a computational capacity of the
computational resource.

66. The apparatus of claim 58 further comprising:

retrieving means for retrieving the target identifier
20 using the information associated with the target identifier;
and

performing means for performing a computational process
on a computational resource identified by the target
identifier.

67. The apparatus of claim 64 wherein the computational
resource identified by the target identifier is a memory
resource.

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68. The apparatus of claim 64 wherein the computational resource identified by the target identifier is a data processing system.

5 69. The apparatus of claim 58 wherein the information associated with the target identifier comprises the target identifier.

10 70. The apparatus of claim 58 wherein the data structure is a table, and the location identifier is a table index.

71. The apparatus of claim 58 wherein the source identifier is a network protocol address.

15 72. The apparatus of claim 58 wherein the target identifier is a network physical address.

20 73. The apparatus of claim 58 wherein the target identifier is a Uniform Resource Identifier (URI).

74. A computer program product on a computer readable medium for use in a data processing system for mapping a source identifier to a target identifier, the computer program product comprising:

25 instructions for hashing the source identifier to determine a location identifier of an entry in a data structure in a computer readable medium; and

30 instructions for reading information associated with the target identifier from the entry in the data structure using the location identifier, wherein the information associated with the target identifier has been related to

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and stored in the entry based on a computed value from a relation computation using the location identifier and the target identifier as operands in the relation computation.

instructions for generating, for each target identifier in the set of target identifiers, a computed value using the location identifier of the particular entry in the data structure and a target identifier as operands in the relation computation to obtain a set of computed values;

instructions for determining a related target identifier for the particular entry based on the chosen computed value, wherein the chosen computed value was computed using the related target identifier as input.

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        instructions for obtaining a set of target identifiers;
and

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25 instructions for relating, for each entry in the data structure, a target identifier from the set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier; and

instructions for storing, in each entry in the data structure, information associated with its related target identifier.

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        instructions for dynamically removing a target
        identifier from a set of target identifiers to obtain a
        modified set of target identifiers;

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instructions for storing, in each entry in the data structure previously related to the removed target identifier, information associated with its newly related target identifier.

instructions for dynamically adding a target identifier to a set of target identifiers to obtain a modified set of target identifiers; and

instructions for relating, for each entry in the data structure, a target identifier from the modified set of target identifiers to an entry in the data structure such that each entry in the data structure is related with only one target identifier; and

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instructions for storing, in each entry in the data structure, information associated with its related target identifier if its related target identifier differs from a target identifier previously related to the entry in the data structure.

79. The computer program product of claim 74 wherein the relation computation further comprises:

instructions for receiving the location identifier and the target identifier as operands for the relation computation;

instructions for hashing the location identifier to generate a first hash value;

instructions for hashing the target identifier to generate a second hash value; and

instructions for hashing the first hash value and the second hash value to generate a computed value.

80. The computer program product of claim 74 further comprising:

instructions for obtaining a set of target identifiers, wherein each target identifier identifies a computational resource such that each target identifier is related with only one computational resource.

81. The computer program product of claim 74 further comprising:

instructions for associating a computational resource with a subset of a set of target identifiers, wherein each target identifier in the set of target identifiers is related with only one computational resource, wherein each

target identifier in the subset of target identifiers identifies the computational resource, and wherein a size of the subset of target identifiers is proportional to a computational capacity of the computational resource.

82. The computer program product of claim 74 further comprising:

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10      instructions for performing a computational process on
      a computational resource identified by the target
      identifier.

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84. The computer program product of claim 80 wherein the computational resource identified by the target identifier is a data processing system.

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30 87. The computer program product of claim 74 wherein the
source identifier is a network protocol address.

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88. The computer program product of claim 74 wherein the target identifier is a network physical address.

- 5 89. The computer program product of claim 74 wherein the target identifier is a Uniform Resource Identifier (URI).

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